NOT FOR PUBLICATION

# ENTOMOLOGICAL ASPECTS OF THE 1956 SPRUCE BUDWORM CONTROL PROJECT IN SOUTHERN IDAHO

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## INTRODUCTION

The second large-scale aerial spray project to control the spruce budworm, Choristoneura fumiferana (Clem.), in southern Idaho fir forests was completed on July 25, 1956. A total of 475,901 acres was sprayed under the direction of the National Forest Administration, Region 4, at a cost of 85.5 cents per acre.

The original recommendations of the Southern Idaho Forest Pest Action Council for the 1956 project included the treatment of approximately 449,390[1/] acres in three central units. Refinement of acreage figures and the addition of an infestation on the Targhee resulted in the following:

| Unit | Forest | Acres | Number of spray blocks |
|---|---|---|---|
| I | Salmon N. F. | 139,805 | 27 |
| II-E | Boise N. F. | 145,149 | 26 |
| II-W | Boise N. F. | 76,823 | 21 |
| III | Payette N. F. | 98,112 | 24 |
| Added | Targhee N. F. | 16,012 | 5 |
| | | 475,901 | 103 |

During the past two years (1955-1956), 1,369,115 acres of epidemic infestations have been treated at a total cost of $1,183,000 or about 86.4 cents per acre.

## RESULTS OF THE 1956 PROJECT

Spraying operations began on June 25 and ended on July 25. There were 28 days of flying, averaging 16,996 acres sprayed daily. Closer appraisal of the project can be made by analyzing the units involved.

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1/ Southern Idaho Pest Action Council report.

## Unit I - Salmon National Forest

Unit Description: Unit I encompassed 139,805 acres and an additional 16,012 acres on the Targhee National Forest. Thus, 155,817 acres were flown from the airstrip at Salmon, Idaho.

The Salmon unit was divided into 27 spray blocks. The range of altitude within the spray area was from about 4,000 to 8,500 feet. The Salmon River, the major drainage, split this area practically in the middle, dividing it into north and south areas. The terrain was generally steep, with deep canyons, though the ridges were rounded in the south section and more or less sharp in the north section.

The Targhee unit was divided into 5 spray blocks, ranging in altitude from 6,000 feet to about 8,000. Four of the spray blocks faced south and the fifth faced east. The south and east boundaries were the edge of type or where the sagebrush plains met the fir forest.

Spray Operations. Spraying began on June 25 on the Salmon area and ceased on July 15. There were 19 days of spraying, averaging 8,201 acres daily. The Targhee spraying involved approximately 140 miles of ferry or about 1-1/2 hours to complete a round trip, including spray time. Two B-18 airplanes were used on this unit.

Larval Development. The Biologist, Arthur R. Tooley, arrived on the Salmon National Forest on May 22; the Assistant Biologist, Victor L. Blackburn, on June 5 and the eight Insect Checkers on June 7.

The spruce budworm was found breaking hibernation on May 24 at 5,000-foot elevation on the Salmon area and on May 22 at 6,000 feet on the Targhee area. Within the week, breaking of hibernation had been observed up to elevations of 7,200 feet.

Sampling at collection points for larval development was hindered somewhat at first by transportation difficulties. By June 15 regular representative sampling was being accomplished. The rate of larval development was determined by obtaining 100 larvae from a collection plot and segregating them by instars through measurement of larval head widths. A spot check, made in areas not sampled by regular collections consisted of collecting 50 larvae from each location. It soon became evident, through these collections, that the spray blocks would have to be split at the 6,500-foot contour. This was done in order to obtain maximum mortality through timing the release of blocks for spraying at the best stage for each altitudinal zone. During the sampling of development, larvae were readily found in instars ranging from the third to sixth; in two cases from the second instar to pupae. Samples containing larvae in the second and sixth instars were not uncommon at the higher elevations, 7,000 to 8,000 feet. This wide a range made the timing of the release of areas to be sprayed rather difficult.

Altogether, 27 larval development collection plots were established, one in each spray block, within the Salmon area. Elevation of these collection plots ranged from 4,000 to 7,500 feet. In addition, 11 spot checks were taken within the unit at elevations ranging from 4,700 to 7,200 feet; the majority were located in the elevations above 6,500 feet. The Targhee area was spot checked rather infrequently for rate of larval development because of the distance from Salmon, Idaho, to the Targhee National Forest. A total of 11,980 larvae were collected in determining the rate of development in all areas in Unit I.

Mortality and Card Line Data. Sampling for larval mortality was done exactly as in previous spruce budworm control projects. Mortality lines consisted of 10 sample plots, each 5 chains apart, running at right angles to the countours. At each plot site during the pre-spray count, 10 branches 15 inches long (2 branches from each of 5 trees) were carefully clipped over a collecting cloth and every tip carefully examined for larvae. All live larvae, pupae and freshly emerged pupal cases, if present, were recorded. During the post-spray count this same procedure was used, from the same trees, except that 20 branches (4 from each of 5 trees) were examined.

Pre-spray counts were taken 2 to 3 days prior to spraying. Post-spray counts were taken 10 days after the mortality line was sprayed.

The percent mortality was derived from the following formula:

$$\% \text{ Mortality} = \frac{\text{Before Spray Count } x\ 2 - \text{After Spray Count}}{\text{Before Spray Count } x\ 2} = 100$$

The goal this year was to establish mortality lines in 60 percent of the spray blocks. In Unit I, 20 lines were established in a possible 27 spray blocks; thus 74 percent of the spray blocks were sampled for mortality. In addition, 2 mortality lines were established on the Targhee area, but one was dropped from consideration because the block was not sprayed.

Based on the total number of larvae collected during the pre-spray and post-spray counts, the percent mortality for Unit I, Salmon National Forest, is as follows:

$$\% \text{ Mortality} = \frac{3314 \times 2 - 355}{3314 \times 2} \times 100 = 94.7\%$$

The percent mortality ranged from 80.7 to 100.

There were 12 card lines established in the Salmon area. Five of these were within the spray blocks containing mortality lines. Two of those lines in spray blocks 23 and 9 showed rather poor coverage; the rest showed good coverage.

Spray block 3 was the only block lacking either card or mortality line.

In the Targhee area, 2 mortality lines and 5 card lines were established. Targhee forest personnel established and retrieved the spray deposit cards. Three of these lines showed adequate coverage and two lines apparently received no spray. Of the two mortality lines, Spray Block 1 showed 95 percent mortality and Spray Block 5 revealed none.

## Unit II-E Boise National Forest

Unit Description. Unit II encompassed 145,149 acres divided into 26 spray blocks.

The altitudinal range within the spray areas was from 4,900 to 9,000 feet in elevation. The Middle Fork of the Salmon River formed the east boundary, Snowshoe ridge on the west, Big Baldy Mountain on the north, and the north side of Blue Bunch Ridge on the south.

The terrain is mountainous. The Middle Fork Salmon River forms the main canyon. In general, the tributaries up to about 6,500 feet in elevation were rough canyons, but the heads of the tributaries were rounded, glaciated, bowl-type terrain. Sulphur Creek, in the south portion, and all its tributaries were broad, rounded valleys. Pistol Creek, in the north portion, is a typical mountain drainage; i.e., not of a sharp V-shape, except at the mouth or Middle Fork Salmon, where the heads of its tributaries are rounded basins. Forty-four Creek is possibly the roughest terrain for spraying because of a poor approach over the ridge.

Spray Operations. The 18 days of spraying began on July 5 and ceased on July 25. The average daily spray was 8,029 acres. The majority of the spraying was done by an A-20; two tri-motor Fords and two B-18 airplanes were added during the latter stages of the spray operations in this unit.

Larval Development. The Biologist, Willard E. Mineau, the Assistant Biologist, William T. Slack, and the Insect Checkers arrived in Pistol Creek on June 7. W. T. Slack and two Insect Checkers remained there, and Assistant Biologist, Allan R. Foltz, and two Insect Checkers arrived at the Sulphur Creek camp on June 12. W. E. Mineau and two Insect Checkers arrived at Landmark Ranger Station on June 18. Between June 7 and 17, Mineau traveled the circuit training the Insect Checkers.

The budworm had broken hibernation when the crews arrived at Pistol Creek and Sulphur Creek, at elevations of 4,900 and 5,500 feet, respectively. Hibernation was not broken in the Landmark area until about June 20, between 7,200 to 7,900 foot elevation.

Larval development in Unit II-E would be considered normal, or at least not fast. Here again spray blocks were split according to larval development at the 6,500-foot contour; and 12 spray blocks were split again at the 7,500-foot contour. This was not only feasible from the standpoint of larval development, but should have been beneficial to the spray operations from the time element involved.

The broad range in larval development through the extreme instars was quite common in the high elevations and extended down to about 6,500 feet.

In this unit 35 larval development collection plots were established. Twenty-three of the 26 spray blocks included collection plots, and 12 spray blocks contained two collection plots each. There were 31 spot checks established within 17 of the spray blocks. All spray blocks were sampled for larval development. The value of this lies in the fact that the data accumulated gave greater knowledge of the insect activity to aid in proper timing of the release of blocks for spraying. The collection plots ranged from 5,000 to 7,960 feet in elevation and the spot checks from 5,550 to 8,500 feet. Some 12,140 larvae were collected in determining the rate of development.

Mortality and Card Line Data. There were 17 mortality lines established in this unit in a possible 26 spray blocks; thus 65 percent of the spray blocks were sampled for mortality.

Based on the total number of larvae collected during the pre-spray and post-spray counts, the percent mortality for Unit II-E, Boise National Forest is:

$$\% \text{ Mortality} = \frac{3387 \times 2 - 1,000}{3387 \times 2} = 85.2\%$$

The percent mortality ranged from 43.4 to 100.

Eleven of the 14 card lines established in this unit were in blocks containing mortality lines; 1 of these blocks had 2 card lines. There were 8 blocks lacking both mortality and/or card lines. Considering the inaccessibility of this unit--all work had to be done on foot and horseback--the fact that 65 percent of the spray blocks were checked for mortality is outstanding.

Results in the Pistol-Sulphur unit were judged unsatisfactory on a unit basis since mortality averaged only 85.2 percent. Based on our present knowledge, mortalities from 95 to 100 percent are satisfactory; 90 to 94 percent might be judged rather poor; and below 90 percent unsatisfactory. This does not necessarily mean tnat populations will soon regain damaging levels, but it must be recognized that it could happen.

Several factors apparently entered the picture. For considerable time only one plane, an A-20, was available for work on the unit. While the A-20 worked well on the Payette National Forest and in portions of this unit, it appeared to people working in the area to be too fast in the rougher areas. The tendency in rough country, in any case, is to fly high; this can contribute to misses and poor overlapping of swaths. Records indicate that too long a time elapsed between start and finish in some blocks; this probably allowed considerable pupation before the blocks could be finished. Because of limited availability of aircraft, it was practically impossible to keep up with the insect development. For example, during the first seven days in the unit, 44,605 acres were released but only 24,672 were sprayed.

As soon as deposit cards and preliminary mortality observations indicated that spraying was less effective than desirable, personnel made spot checks and reconnaissance trips through all doubtful areas. Results indicated both poor spray deposit and late spraying were responsible for generally unsatisfactory results. While it was impossible in a short time to set boundaries on all areas where excessive survival occurred, it is estimated from available data that it may well be as much as 40,000 acres.

Under the circumstances, it is planned to watch the area in the next year or two to determine if the remaining infestation builds up rapidly. However, because of known side-effects of aerial spraying on streams, respraying of large areas is not desirable for about 4 years.

## Unit II-W Boise National Forest

Unit Description. Unit II-W encompassed 76,823 acres and was divided into 22 spray blocks, one of which, Spray Block 21A, was added during the project to circumscribe an additional infestation. The altitudinal range within the spray area was from 4,200 to 7,900 feet in elevation. The unit consisted of two separate areas--the Johnson Creek area and the Monument Peak - Silver Creek area. The terrain of both areas was typical of southern Idaho mountains.

Spray Operations. Spraying began on July 4 and ceased on July 19. There were 14 days of spraying averaging 5,487 acres daily. In the main, one Ford Trimotor airplane was used in this area. However, in a few days this plane was assisted by another Ford and an A-20.

Larval Development. The Biologist, Warren L. Roe, Jr., and the Assistant Biologist, Donald R. Sutherland, arrived on the unit on June 7. Roe was based at Cascade, Idaho, and Sutherland at Silver Creek Guard Station in the southern part of the unit. The 5 Insect Checkers arrived on the same day.

The date of the larvae first breaking hibernation cannot be accurately established since the larvae were in the buds at the time the Biologist arrived. However, on May 25 the larvae had not broken hibernation; on June 11 only 2 percent remained in the second instar. Thus, it can be assumed that hibernation was broken around June 1. This unit was basically one of cold air drainages; therefore larval development was slower.

The 15 larval development collection plots were regularly sampled, and 62 spot checks made within this unit. These collections were taken between 4,200 to 7,300 foot elevation; the majority of the spot checks were concentrated above 6,500 feet.

In some blocks it was advantageous to split the block at the 6,500-foot contour.

There were 13,503 larvae collected from these plots in determining the rate of development.

Mortality and Card Line Data. The 20 mortality lines established in this unit included a possible 22 spray blocks. However, spray blocks 5, 6, 9, and 21A were not sampled, but spray blocks 10, 11, and 13 included two lines--one in the area below 6,500 foot and one in the area above 6,500 foot. Thus, 77 percent of the spray blocks were checked for mortality.

Based on the total number of larvae collected during the pre-spray and post-spray counts, the percent mortality for Unit II-W, Boise National Forest, is:

$$\% \text{ Mortality} = \frac{1956 \times 2 - 125}{1956 \times 2} = 96.8\%$$

The percent mortality ranged from 91.8 to 99.3.

The 22 card lines established in this unit were within 18 spray blocks. Twenty-one of these card lines were within blocks containing mortality lines, and 4 spray blocks possessed two card lines. There were 4 spray blocks lacking both mortality and/or card lines.

## Unit III - Payette National Forest

Unit Description. Unit III encompassed 98,112 acres, divided into 24 spray blocks. The spray area ranged from 4,000 to 7,600 foot in elevation. The unit consisted of two separate areas--one lying between Cuprum, Idaho, and Lost Valley Reservoir, and the other lying south and east of Cuddy Mountain. The Cuprum area was mainly of southern exposure and slope; Cuddy Mountain formed the west boundary of the other area, and the majority of the spray

blocks had easterly exposures. The terrain was typical of this country with a few deep canyons in the south part of the Cuprum area and the Snake River Canyon on the west side of both areas comprising the rough flying portions.

Spray Operations. Spraying began on June 26 and ceased on July 18. However, larval development prevented spraying in this unit between July 5 and 15, inclusive. In the 11 days of spraying, the daily average was 8,919 acres. The A-20 was used almost exclusively in this unit, but had some aid from the Ford Tri-motor and B-18.

Larval Development. The Biologist and Assistant Biologist, Delbert C. Hanson and Donn B. Cahill, respectively, arrived in the unit on June 5. The six Insect Checkers arrived on June 6.

On May 25 the larvae were found to have broken hibernation. Larval development was quite rapid in this unit, and by the week of June 21-26 from 55 to 92 percent of the larvae were in the sixth instar, with no pupation occurring. These collections by the Biologist, a graduate entomologist, should be considered highly reliable. The first pupation was recorded on July 1; however, pupation did not occur to any serious extent until after all of the spray blocks below 6,500 feet had been sprayed. This pupation occurred only in the residual population after the area had been sprayed.

The 26 larval development collection plots were regularly sampled, and 12 spot checks were made within this unit. Including the spot checks, every spray block was sampled. The collection plots sampled the full altitudinal range.

The 10,351 larvae collected from these plots were used in determining the rate of development.

Mortality and Card Line Data. Since 12 mortality lines were established in this unit in 24 spray blocks, 50 percent of the spray blocks were checked for mortality. Based on the total number of larvae collected during the pre-spray and post-spray counts, the percent mortality for Unit III, Payette National Forest is:

$$\% \text{ Mortality} = \frac{1501 \times 2 - 115}{1501 \times 2} = 96.2\%$$

The percent mortality ranged from 86 to 100.

Of the 12 card lines established in this unit, 5 were within blocks having mortality lines. There were 5 spray blocks lacking both mortality and/or card lines.

## SUMMARY

Between June 25 and July 25, a total of 475,901 acres was sprayed. In the 28 days suitable for spraying, a daily average of 16,997 acres was sprayed.

The altitudinal range of the spray areas was from 4,000 to 9,000 feet in elevation. The larval development rate caused the spray blocks to be split at the 6,500-foot contour; and in 12 spray blocks, again at the 7,500-foot contour. This was advisable for proper timing for best spray results. A broad range in larval development was found commonly in the higher elevations.

The larval development rate and mortality data were sampled and calculated as has been done in the past. There were 103 larval development check points and 120 spot checks established. Sixty-nine percent of the blocks were sampled with mortality lines and 63 percent checked with spray deposit cards.

The results of the 1956 Spruce Budworm Control Project are summarized in Table 1.

Table 1. Summary of Results of the 1956 Spruce Budworm Control Project

| Unit | Forest | Acreage | Number spray blocks | Number larval develop collec. plots | Number larval develop spot checks | Number card lines | Number mort. lines | Percent spray block sampled (mort.) | Range of percent mort. | Average percent mort. |
|---|---|---|---|---|---|---|---|---|---|---|
| I | Salmon | 139,805 | 27 | 27 | 11 | 12 | 20 | 74 | 80.7-100 | 94.7 |
| II-E | Boise | 145,149 | 26 | 35 | 31 | 14 | 17 | 65 | 43.4-100 | 85.2 |
| II-W | Boise | 76,823 | 21 | 15 | 72 | 22 | 20 | 77 | 91.8-99.3 | 96.8 |
| III | Payette | 98,112 | 24 | 26 | 12 | 12 | 12 | 50 | 86.0-100 | 96.2 |
| Added | Targhee | 16,012 | 5 | -- | 4 | 5 | 1 | 20 | 95.6 | 95.0 |
| Total | | 475,901 | 103 | 103 | 120 | 65 | 70 | 67.9 | 43.4-100 | 89.9 |

# SPRUCE BUDWORM SITUATION

SOUTHERN IDAHO

BOISE, PAYETTE, SALMON, CHALLIS & TARGHEE NATIONAL FORESTS

OCT. 1956

SCALE 0 10 20 30 40 MILES

**LEGEND**

| | |
|---|---|
| TREATED AREA PINE BUTTERFLY | 1954 |
| TREATED AREA BUDWORM | 1955 |
| TREATED AREA BUDWORM | 1956 |